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Campbell-Brown et al.

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(54) **VENT THROUGH A PRINTHEAD SUPPORT STRUCTURE**

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B41J 2/14	(2006.01)

(52) **U.S. Cl.**

CPC ***B41J 2/1752*** (2013.01); ***B41J 2/14*** (2013.01); ***B41J 2/17513*** (2013.01); ***B41J 2/17523*** (2013.01); ***B41J 2/17553*** (2013.01); ***B41J 2/19*** (2013.01); *B41J 2202/02* (2013.01)

(58) **Field of Classification Search**

CPC B41J 2/14; B41J 2/19; B41J 2/17513; B41J 2/1752; B41J 2/17523; B41J 2/17553; B41J 2202/02

USPC 347/49, 86, 92

See application file for complete search history.

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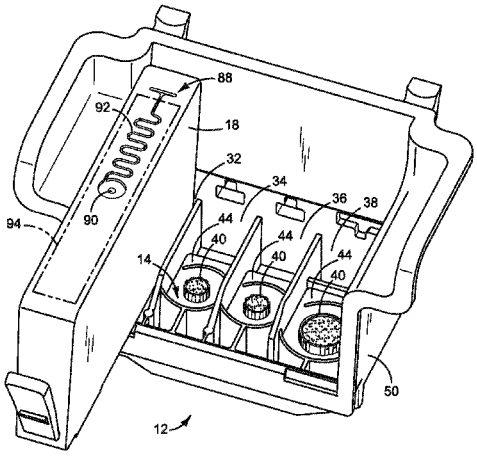
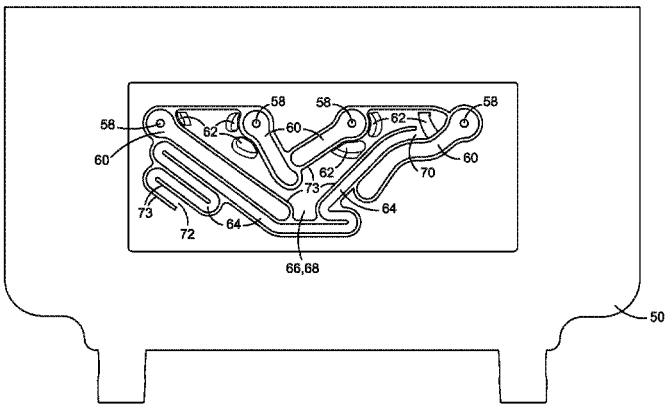
(57) **ABSTRACT**

In one example, a structure for supporting a printhead includes: a substrate having a first side and a second side; an inlet tower through which liquid may be introduced into the structure; an opening through the substrate near the inlet tower; and an air channel along the substrate connecting the opening in the substrate to the atmosphere.

17 Claims, 9 Drawing Sheets





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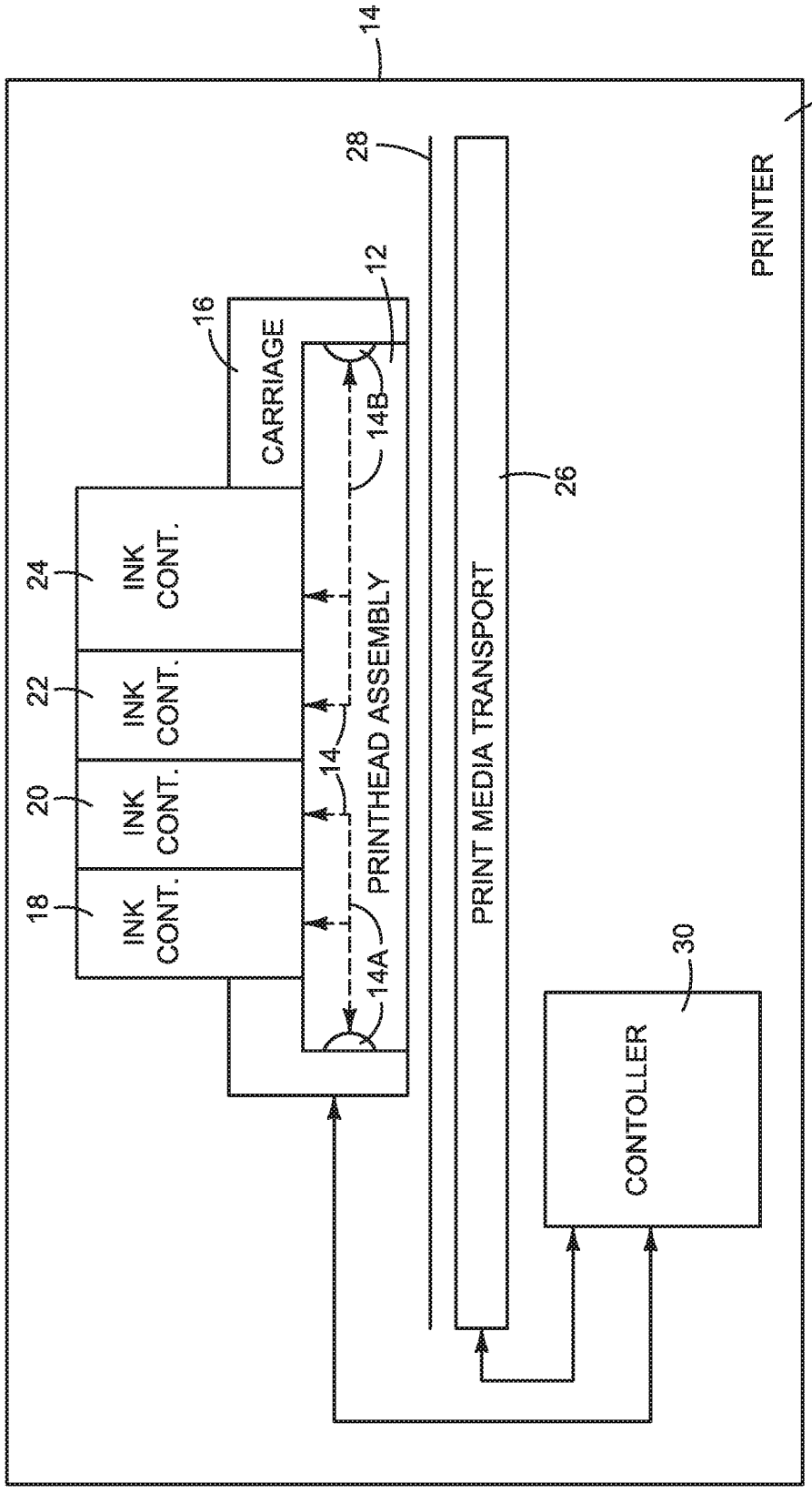
14
10
PRINTER
28
12
16
CARRIAGE
14B
26
PRINT MEDIA TRANSPORT
24
INK CONT.
22
INK CONT.
20
INK CONT.
18
INK CONT.
14
PRINTHEAD ASSEMBLY
14A
30
CONTOLLER

FIG. 1

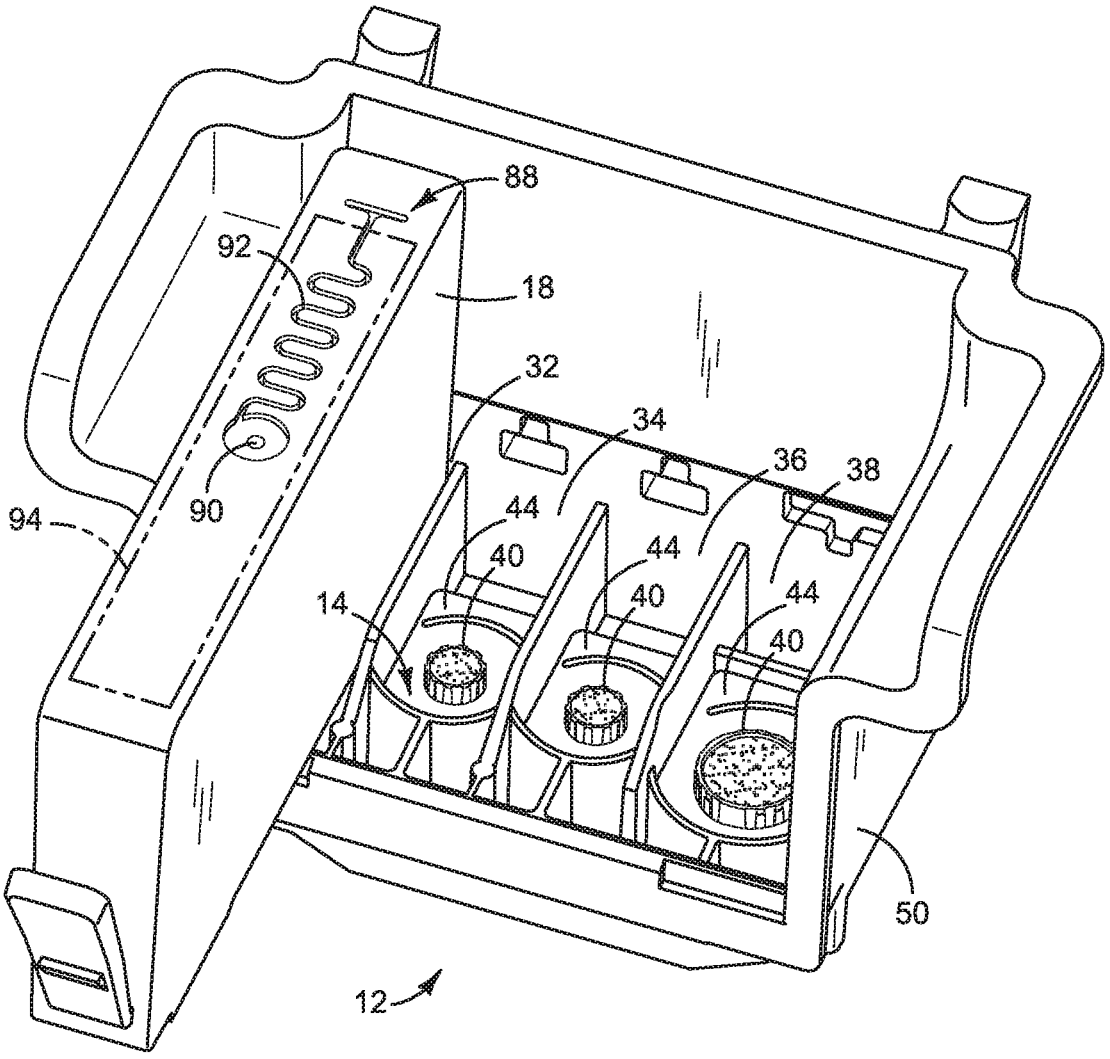

FIG. 2

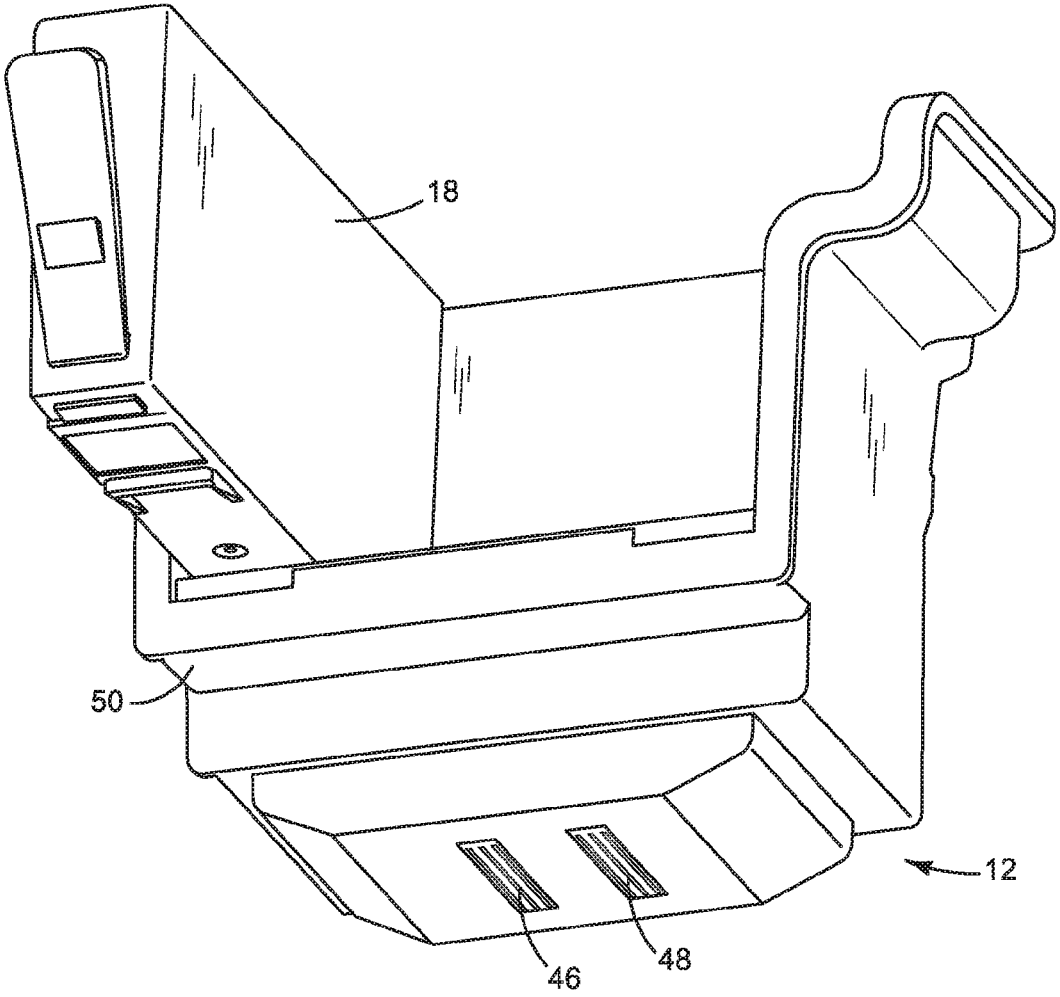

FIG. 3

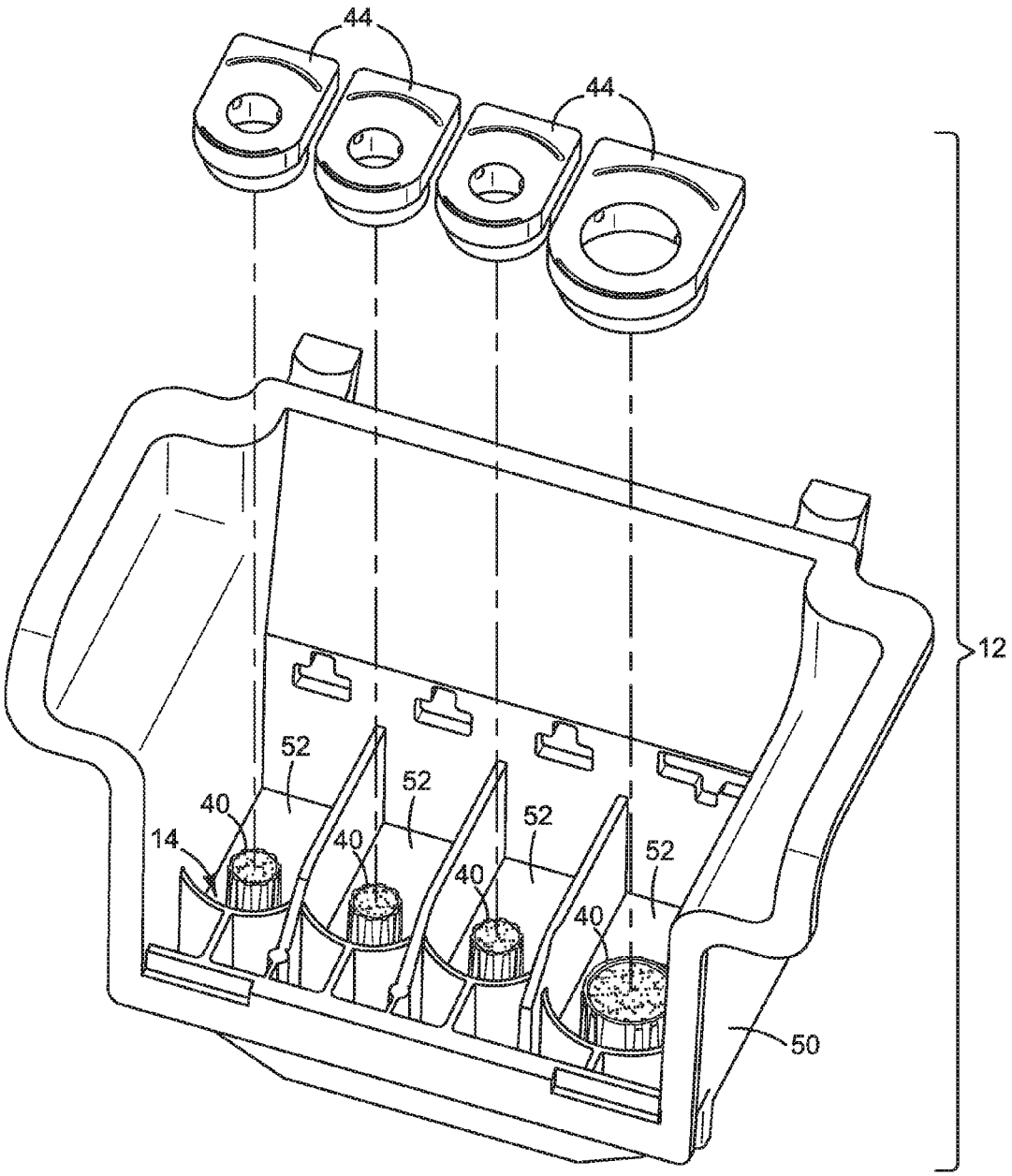

FIG. 4

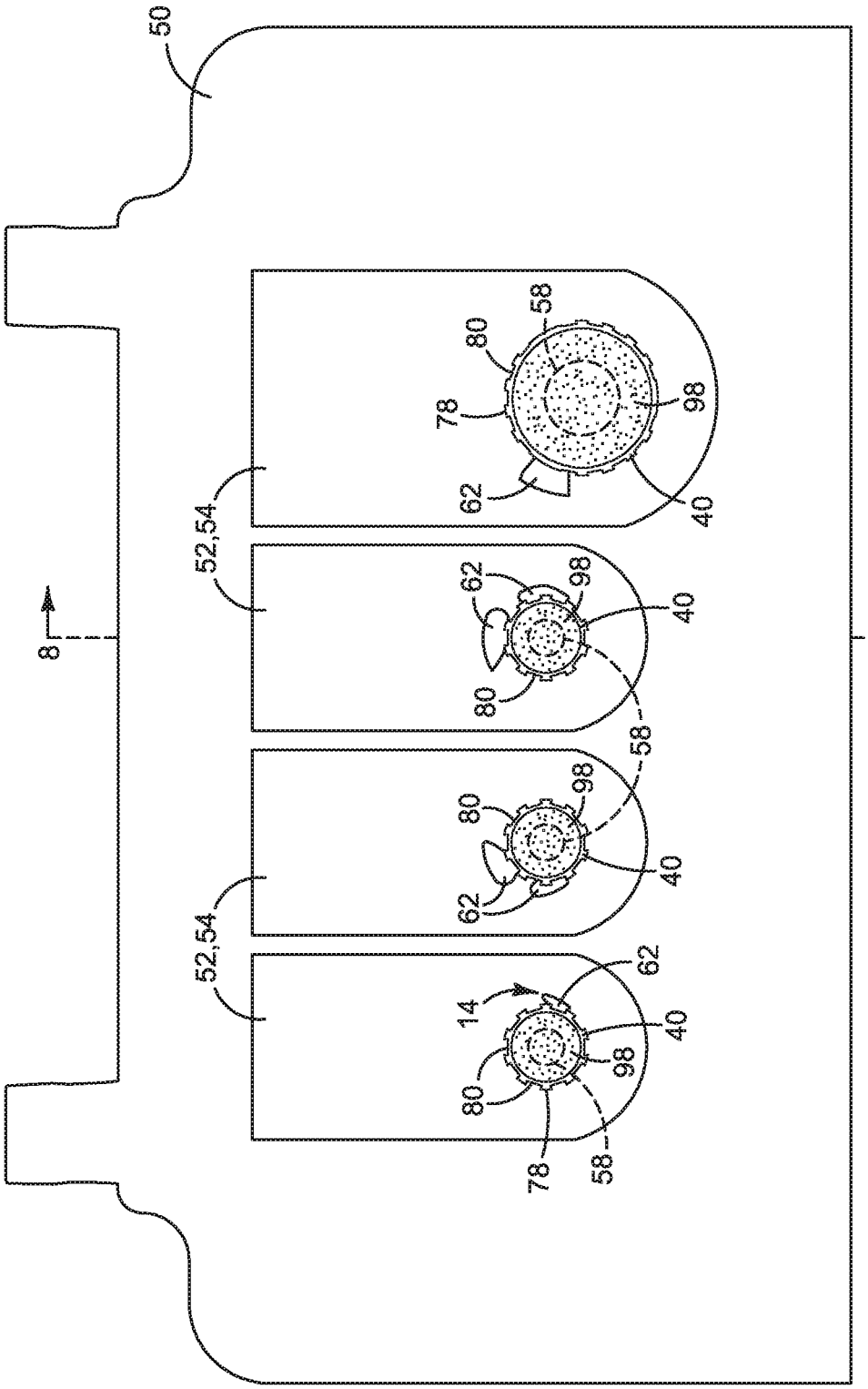

FIG. 5

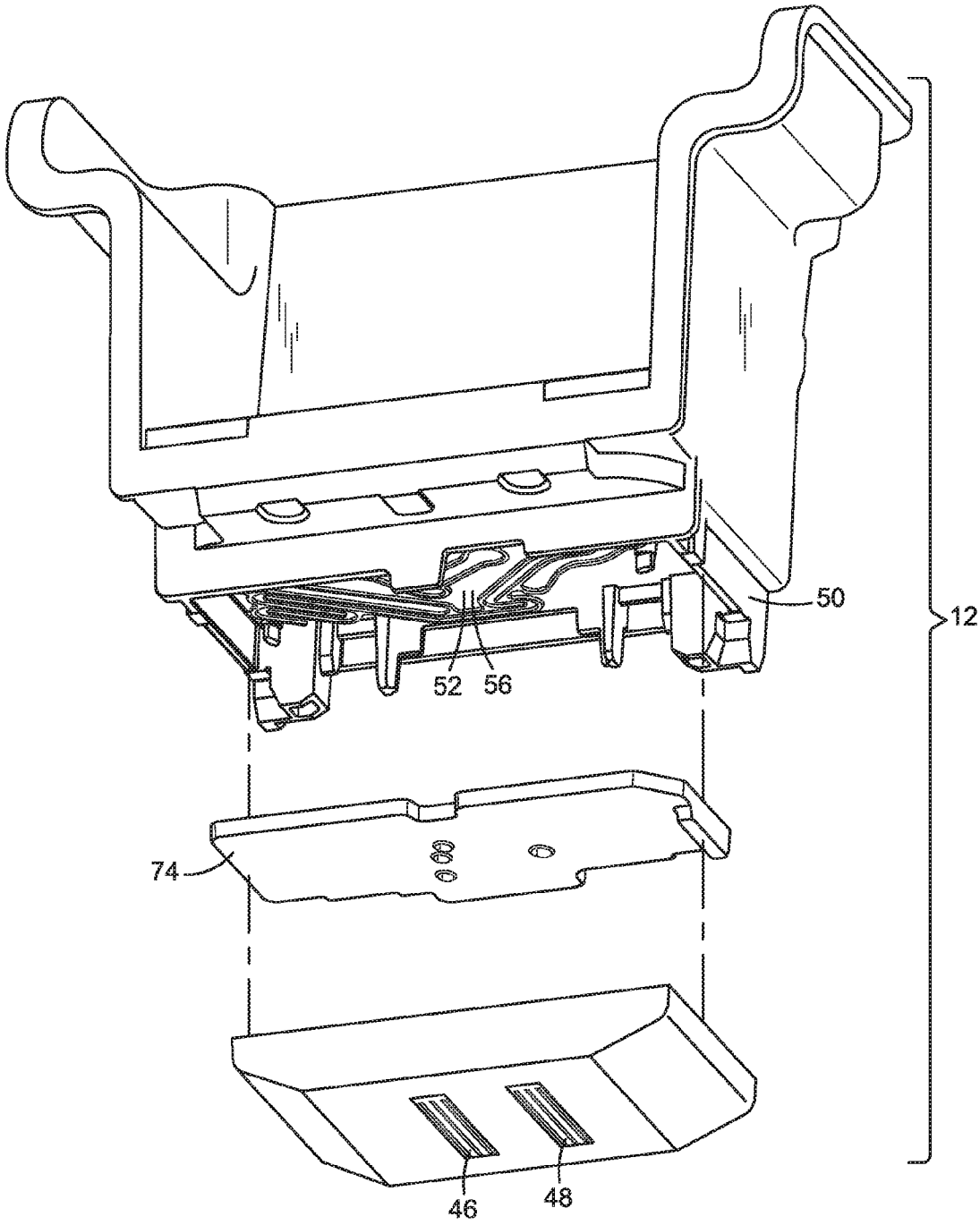

FIG. 6

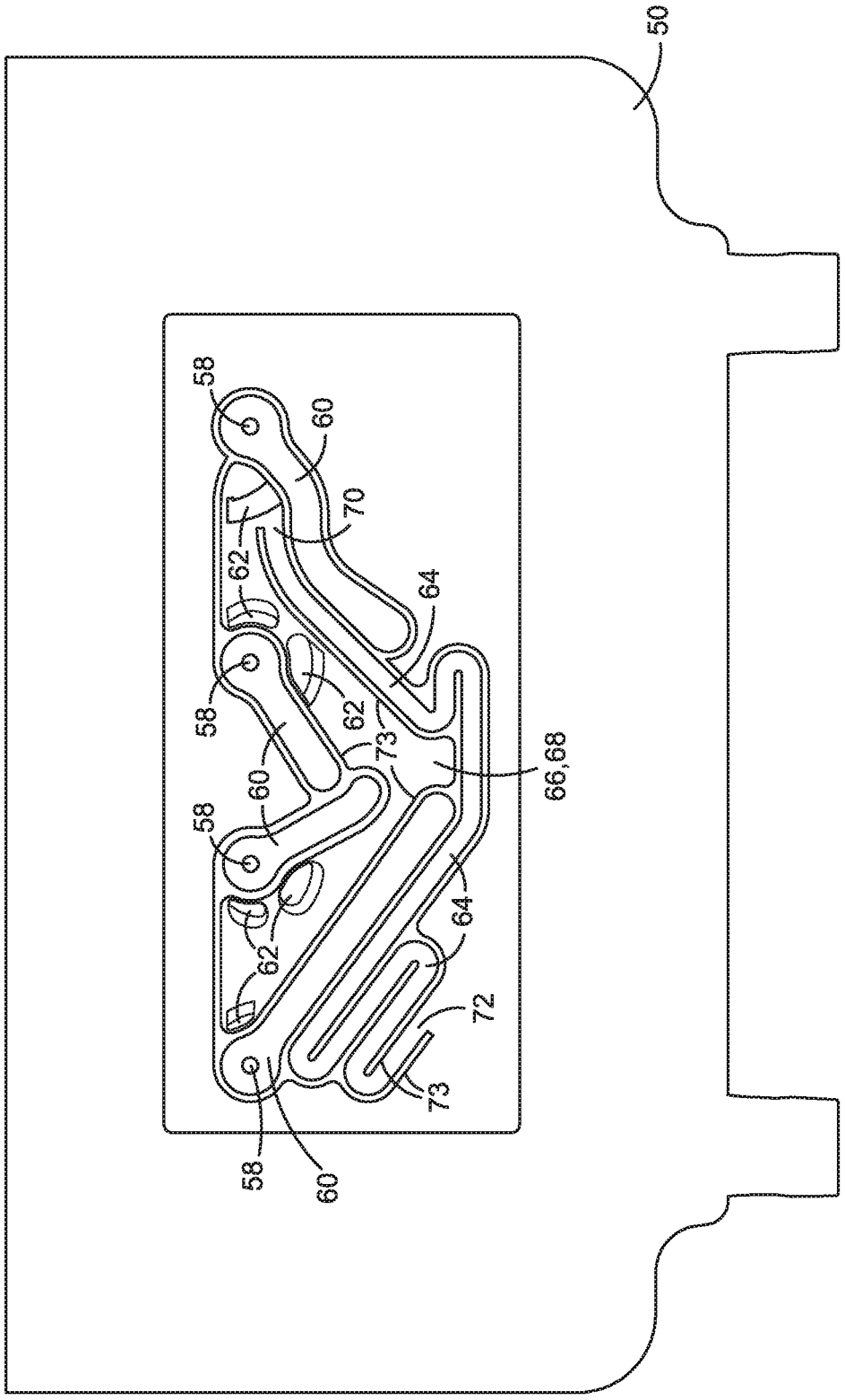

FIG. 7

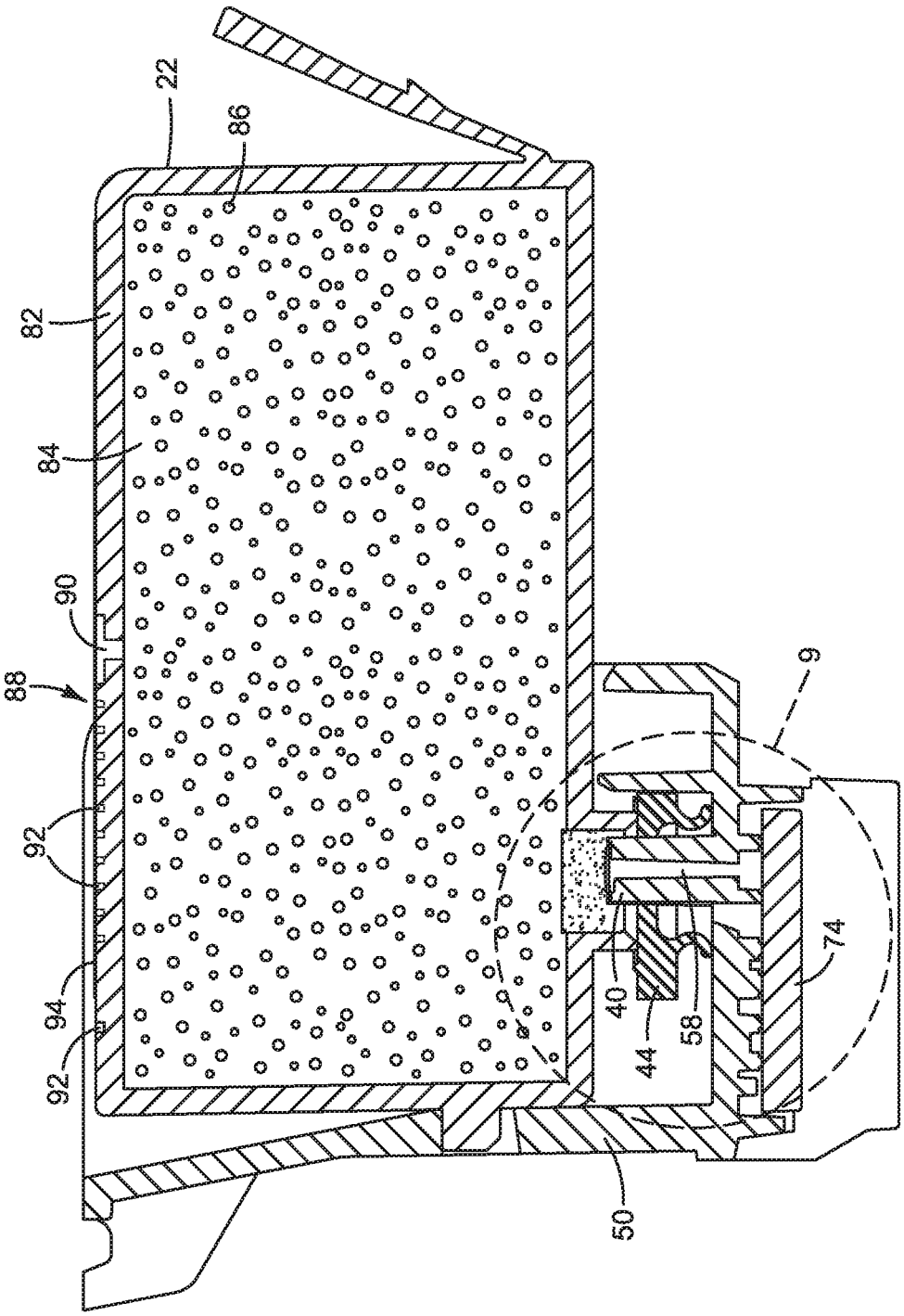

FIG. 8

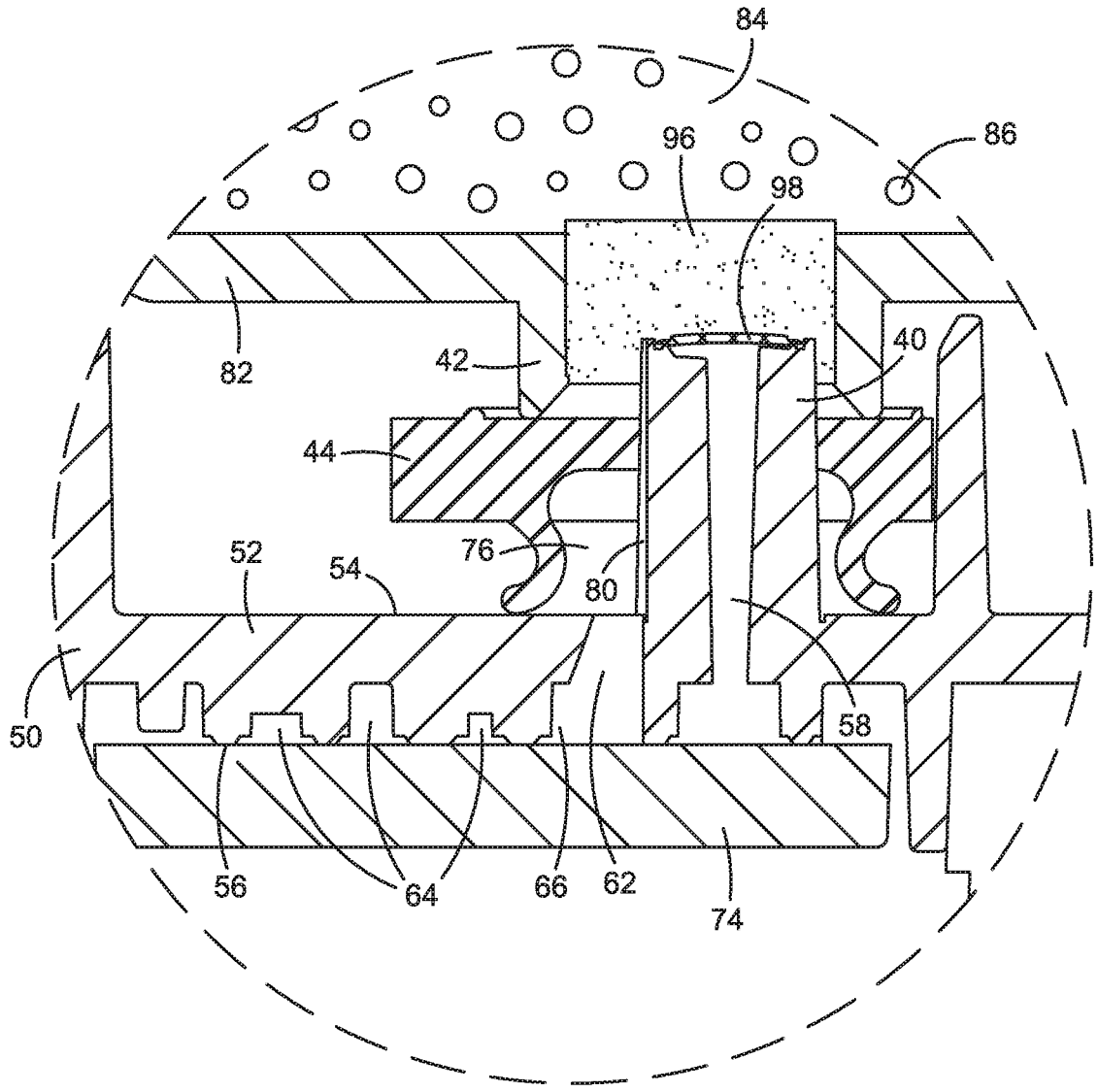

FIG. 9

VENT THROUGH A PRINTHEAD SUPPORT STRUCTURE

This patent application is a continuation application of U.S. patent application Ser. No. 14/373,524, filed Sep. 19, 2014, titled "VENT THROUGH A PRINTHEAD SUPPORT STRUCTURE," which is a national stage application of PCT Application Serial No. PCT/US2012/029608, filed Mar. 19, 2012, the relevant contents of each of these applications herein being incorporated by reference.

BACKGROUND

In some inkjet printers, the printheads are part of a discrete assembly separate from detachable ink containers in which ink is held in a block of foam or other capillary material. The ink holding chamber in these foam based ink containers is vented to the atmosphere through an opening in the top of the container. The container vent opening is sealed during storage and shipment to prevent evaporation from the ink chamber. The container vent is sometimes not functional when the container is installed in a printhead assembly, for example when the user fails to remove the vent seal. The printer will not print properly with a malfunctioning container vent.

DRAWINGS

FIG. **1** is a block diagram illustrating an inkjet printer with a printhead assembly implementing one example of a new container vent.

FIGS. **2** and **3** are perspective views illustrating a printhead assembly implementing one example of a new container vent.

FIG. **4** is an exploded top side perspective view of the printhead assembly of FIGS. **2** and **3**.

FIG. **5** is a top down plan view showing the printhead assembly of FIGS. **2-4** with the tower seals removed to expose the vent holes in the substrate of the printhead support structure.

FIG. **6** is an exploded bottom side perspective view of the printhead assembly of FIGS. **2-5**.

FIG. **7** is a bottom plan view of the printhead assembly of FIGS. **2-6** with the manifold cover removed to expose the air plenum and air channel along the underside of the printhead support structure substrate.

FIG. **8** is a section view of the printhead assembly of FIGS. **2-7** taken along the line **8-8** in FIG. **5** showing a vent path from the ink container outlet through the printhead assembly.

FIG. **9** is a detail view of the vent path shown in FIG. **8**.

The same part numbers designate the same or similar parts throughout the figures.

DESCRIPTION

A vent through the printhead assembly has been developed as an addition or alternative to the conventional vent on a detachable ink container. The new vent allows the container to supply ink to the printhead assembly even if the vent on the ink container malfunctions, for example if the user fails to remove the tape sealing the vent or if there is a defect in the vent that prevents air from reaching the ink chamber inside the container. In one example of the new vent, an air hole is formed through the substrate of a printhead support structure near the ink inlet so that the container ink outlet is exposed to the air hole when the container outlet is engaged with the ink inlet on the printhead assembly (i.e., when the ink container is installed on the printhead assembly). An air channel on the back side of the substrate connects the air hole to the atmosphere, thus venting the ink container to the atmosphere through the printhead assembly when the container is installed in the printhead assembly.

Examples of the new vent are described with reference to ink containers for an inkjet printer. However, examples of the new vent are not limited to ink containers, inkjet printers or inkjet printing. Examples of the new vent might also be implemented in other of inkjet type dispensers. The examples shown in the figures and described below, therefore, illustrate but do not limit the invention, which is defined in the Claims following this Description.

As used in this document, "liquid" means a fluid not composed primarily of a gas or gases; and a "printhead" means that part of an inkjet printer or other inkjet type dispenser that dispenses liquid from one or more openings, for example as drops or streams.

FIG. **1** is a block diagram illustrating an inkjet printer **10** with a printhead assembly **12** implementing one example of a new container vent **14**. FIGS. **2-9** Illustrate in detail one example of a printhead assembly **12** with a vent **14** such as might be used in the printer shown in FIG. **1**. Referring first to FIG. **1**, printer **10** includes a carriage **16** carrying printhead assembly **12** and detachable ink containers **18**, **20**, **22**, and **24** that supply ink to printhead assembly **12**. The interior, ink holding chamber of each container **18-24** is vented to the atmosphere through a vent **14** in printhead assembly **12**. In the example shown in FIG. **1**, container vent **14** consists to two separate vents **14**A and **14**B that vent ink containers **18**, **20** and **22**, **24**, respectively. Other configurations for vent **14** are possible. For example, as described below a single vent **14** in printhead assembly **12** may be used to vent all of the ink containers **18-24**.

Printhead assembly **12** includes one or more printheads through which ink from one or more containers **18-24** is ejected. A print media transport mechanism **26** advances a sheet of paper or other print media **28** past carriage **16** and printhead assembly **12**. A controller **30** is operatively connected to carriage **16**, printhead assembly **12** and media transport **26**. Controller **30** represents generally the programming, processor and associated memory, and the electronic circuitry and other components needed to control the operative elements of printer **10**.

Referring now to FIGS. **2** and **3**, printhead assembly **12** includes bays **32**, **34**, **36**, and **38** for receiving detachable ink containers **18-24**, respectively. Only ink container **18** is shown installed in printhead assembly **12** in FIGS. **2** and **3** to better illustrate some of the features of printhead assembly **12**. Printhead assembly **12** includes ink inlets **40** for receiving ink from a corresponding ink outlet **42** (shown in FIG. **8**) on each detachable ink container **18-24**. Each ink inlet **40** is configured as a tower that is surrounded by an annular seal **44** that seals against the bottom of each container outlet **42** when the container is installed in printhead assembly **12**. In the example shown, printhead assembly **12** includes two printheads **46** and **48**. Ink from color ink containers **18-22**, for example, is ejected from printhead **46** and ink from a black ink container **24** is ejected from printhead **48**.

FIGS. **4** and **5** are exploded top side perspective and plan views, respectively, of printhead assembly **12**. The inlet tower seals **44** are omitted in FIG. **5** to better illustrate vent **14**. FIGS. **6** and **7** are exploded bottom side perspective and plan views, respectively, of printhead assembly **12**. The

printheads **46**, **48** and the manifold cover are omitted in FIG. **7** to better illustrate vent **14**. FIGS. **8** and **9** are section views showing vent **14** in more detail.

Referring to FIGS. **4-9**, printhead assembly **12** includes a support structure **50** that supports printheads **46**, **48** and other parts of printhead assembly **12**. Ink inlet towers **40** protrude from a generally planar substrate **52** of support structure **50**. While it is expected that printhead assembly **12** will usually be installed in a printer so that substrate **52** is horizontal during printing operations, as shown in the figures, a horizontal substrate **52** is not required. Indeed, substrate **52** alone or integrated into a printhead assembly **12** might have different orientations during manufacturing, packaging, storing, shipping, and printing. Ink inlet towers **40** protrude from a first side **54** of substrate **52**. Printheads **46**, **48** are mounted to a second side **56** of substrate **52** opposite first side **54**. An ink hole **58** in substrate **52** inside each inlet tower **40** allows ink to flow through each container outlet **42** to printhead **46** or **48** along a corresponding ink channel **60** formed in the second side **56** of substrate **52**. An air hole **62** in substrate **52** near each inlet tower **40** exposes each container outlet **42** to the atmosphere through an air channel **64** formed in the second side **56** of substrate **52**.

In the example shown in the figures, a single air channel **64** vents all four containers **18-24** from an air plenum **66** that connects air holes **62** to air channel **64**. Plenum **66** is defined by a single enclosed space **68** along substrate second side **56** enveloping air holes **62** as best seen in FIG. **7**. One end **70** of air channel **64** is open to plenum **66** and the other end **72** is open to the atmosphere. Also, in the example shown in the figures, the walls **73** defining ink channels **60**, air channel **64**, and plenum space **68** are formed in second side **56** of substrate **52** and closed by a cover **74**. That is to say, three sides of each enclosed space are formed in substrate **52** and the fourth side is formed by cover **74** affixed to substrate **52**. Cover **74** is sometimes called a manifold or manifold cover because it helps define the ink distribution manifold formed by ink channels **60** in printhead assembly **12**.

Each ink inlet tower **40** is surrounded by a seal **44**. Referring specifically to FIGS. **8** and **9**, the bottom of each container outlet **42** is pressed into a corresponding seal **44** to make a fluid tight seal that prevents air and ink from escaping between container outlet **42** and printhead assembly inlet **40**. Seal **44** forms an interior cavity **76** surrounding at least part of inlet tower **40**. Air hole **62** opens into cavity **76**. The outer surface **78** of inlet tower **40** is recessed at the location of air hole **62** so that air can move from cavity **76** past seal **44** to container outlet **42**. In the example shown, multiple recesses **80** are formed along outer surface **78** of inlet tower **42** to achieve the desired air flow between cavity **76** and container outlet **42**.

Still referring to FIGS. **8** and **9**, each ink container **18-24** includes a housing **82** that forms an interior chamber **84** for holding ink. For convenience, only ink container **22** shown in FIGS. **8** and **9** is called out in the following description. Ink in chamber **84** is held in foam or other suitable capillary material **86**. A conventional vent **88** on container **22** vents ink chamber **84** to the atmosphere. A conventional vent **88** usually includes an opening **90** in container housing **82** and a small winding channel **92** covered by an adhesive label **94**. (Label **94** is shown in phantom lines on container **18** in FIG. **2**.) A wick **96** in container outlet **42** forms the fluidic interface between ink container **22** and printhead assembly **12**.

When ink container **22** is installed in printhead assembly **12**, as shown in FIGS. **8** and **9**, wick **96** engages a corresponding inlet tower **40** on printhead assembly **12**, for example through a filter **98**, to establish the operative fluidic connection between ink container **22** and printhead assembly **12**. When container **22** is installed in printhead assembly **12** but not vented correctly through vent **88**, the flow of ink from container **22** into printhead assembly **12** during printing and priming would create to high a vacuum inside ink chamber **84**, starving the printheads for ink. An extra container vent **14** through printhead assembly **12** allows air to pass around and through wick **96** into ink chamber **84** to maintain a correct pressure inside container **22** even if vent **88** fails.

Thus, for each ink container **18-24**, vent **14** follows a path from opening **72** along air channel **64** to plenum **66**, through air hole **62** in substrate **52** to cavity **76** between seal **44** and inlet tower **40**, past inlet tower **40** in recesses **80** to wick **96** in container outlet **42**. It is expected that in most implementations air channel **64** in printhead assembly **12**, like air channel **92** on the containers, will be longer and smaller (in cross section) to help minimize evaporative losses through vent **14**. Air holes **62** in substrate **52** and recesses **80** along inlet tower **40** may be sized and shaped to achieve the desired venting and, where appropriate, to facilitate manufacturing. (Printhead support structure **50** usually will be a molded plastic part.) Multiple smaller air holes **62** around an inlet tower **40**, as shown in FIG. **5**, may be used instead of a single larger hole as necessary or desirable to maintain the rigidity of inlet tower **40** to substrate **52**.

As noted at the beginning of this Description, the examples shown in the figures and described above illustrate but do not limit the invention. Other examples are possible. Therefore, the foregoing description should not be construed to limit the scope of the invention, which is defined in the following claims.

What is claimed is:

1. A structure to support a printhead, the structure comprising:

a substrate having a first side and a second side, the first side including a bay to receive a container;

multiple inlet towers protruding from the first side of the substrate;

a plurality of openings passing through the substrate near each inlet tower of the multiple inlet towers from the first side of the substrate to the second side of the substrate; and

an air channel along the second side of the substrate connecting each opening in the substrate to the atmosphere.

2. The structure of claim **1**, wherein

multiple liquids may be introduced into the structure through the multiple inlet towers.

3. The structure of claim **2**, wherein the air channel comprises a single air channel connecting all of the openings to the atmosphere.

4. The structure of claim **2**, further comprising a single plenum along the second side of the substrate between the openings and the air channel, each opening opening into the plenum such that air may pass from the atmosphere along the air channel to the plenum and through the openings to the first side of the substrate.

5. The structure of claim **1**, further comprising:

a seal surrounding the inlet tower to seal the outlet of a detachable liquid container against the structure when the container is attached to the structure, the seal forming a cavity surrounding the inlet tower on the first side of the substrate and the opening opening into the cavity; and

gaps between the seal and the inlet tower to allow air to escape the cavity along the tower into the outlet of the detachable liquid container when the container is attached to the structure.

6. The structure of claim **5**, wherein the gaps are formed by a series of recesses in an outer surface of the tower at an interface with the seal.

7. A printhead assembly, comprising:

a printhead to dispense ink; and

a structure to support the printhead, the structure including:

multiple ink inlets each to receive ink from an ink container;

an ink manifold to distribute ink from the ink inlets to the printhead; and

multiple vents each associated with and proximate to one of the ink inlets to vent the respective ink container to the atmosphere through the printhead assembly when the respective ink container is attached to the ink inlet.

8. The printhead assembly of claim **7**, wherein each vent includes a vent path that extends from one of the ink inlets to a single plenum common to all of the vent paths and then to an air channel connecting the plenum to the atmosphere.

9. The printhead assembly of claim **8**, wherein the air channel comprises a single, winding air channel connecting the plenum to the atmosphere.

10. The printhead assembly of claim **7**, further comprising a substrate having a first side and a second side opposite the first side, and wherein:

each ink inlet comprises an inlet tower protruding from the first side of the substrate;

the ink manifold comprises multiple ink channels along the second side of the substrate, each ink channel connected to a corresponding inlet tower through an ink opening in the substrate; and

each vent comprises an air opening through the substrate near a corresponding inlet tower and an air channel along the second side of the substrate connecting the air opening to the atmosphere.

11. The printhead assembly of claim **10**, wherein the air channel comprises a single air channel common to all of the vents and each vent also includes a single plenum connected between each air opening and the air channel.

12. The printhead assembly of claim **10**, further comprising:

a seal surrounding each inlet tower to seal the outlet of a detachable ink container against the printhead assembly when the container is attached to the printhead assembly, each seal forming a cavity surrounding the corresponding inlet tower on the first side of the substrate with each air opening opening into the cavity; and

gaps between each seal and the corresponding inlet tower to allow air to escape the cavity along the tower into the outlet of the detachable ink container when the container is attached to the printhead assembly.

13. A method to vent a liquid container, the method comprising:

inserting multiple detachable ink containers into a support structure;

directing ink from each ink container of the multiple ink containers to one ink inlet of multiple ink inlets;

distributing ink from the multiple ink inlets to a printhead; and

venting an interior of each ink container to the atmosphere through a vent path from the support structure to an ink outlet from the interior of the container, the vent path extending from one of the ink inlets to a single plenum and then to an air channel connecting the plenum to the atmosphere.

14. The method of claim **13**, wherein the air channel comprises a single, winding air channel connecting the plenum to the atmosphere.

15. The method of claim **13**, wherein the support structure comprises a substrate having a first side and a second side opposite the first side, and wherein:

each ink inlet comprises an inlet tower protruding from the first side of the substrate;

the second side of the substrate includes multiple ink channels, each ink channel connected to a corresponding inlet tower through an ink opening in the substrate; and

the substrate includes air openings through the substrate near a corresponding inlet tower and an air channel along the second side of the substrate connecting the air opening to the atmosphere.

16. The method of claim **15**, wherein the air channel comprises a single air channel and a single plenum connected between each air opening and the air channel.

17. The method of claim **15**, wherein a seal surrounds each inlet tower to seal the outlet of each detachable ink container against the support structure when the container is attached to the support structure, each seal forming a cavity surrounding the corresponding inlet tower on the first side of the substrate with each air opening into the cavity.

* * * * *